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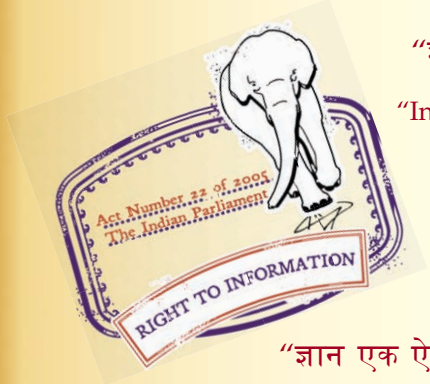

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Indian Standard

TERMINAL MARKINGS FOR ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES

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TERMINAL MARKINGS FOR ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES

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Indian Standard

TERMINAL MARKINGS FOR ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 27 August 1976, after the draft finalized by the Electrical Instruments Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The object of this standard is to lay down a system of marking for the terminals of electrical measuring instruments and their accessories which is obvious and unambiguous so that instruments and accessories so marked may be correctly connected up by technicians without special training and preferably without the need for a diagram of connections. This system is in accordance with international standards such as IEC Pub 117-1(1960) 'Recommended graphical symbols, Part I Kind of current, distribution systems, methods of connection and circuit elements'; IEC Pub 445 (1973) 'Identification of apparatus terminals and general rules for a uniform system of terminal marking, using an alphanumeric notation'; and ISO 2955-1974 'Information processing — Representation of SI and other units for use in systems with limited character sets'.

0.3 In the preparation of this standard, considerable assistance has been derived from Doc : 13B (Secretariat) 250 'Terminal markings for electrical measuring instruments and their accessories' issued by the International Electrotechnical Commission.

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1. SCOPE

1.1 This standard prescribes the terminal markings intended for use with the following instruments:

a) Direct acting indicating electrical measuring instruments and their accessories,

b) Direct acting recording electrical measuring instruments and their accessories,

c) Indirect acting electrical measuring instruments,

d) Standard cells,

e) Direct current potentiometers,

f) Direct current resistive volt ratio boxes,

g) Laboratory direct current resistors,

h) Direct current bridges for measuring resistance,

j) Inductive voltage dividers, and

k) Electrical measuring transducers.

1.1.1 They may also be applied to other electrical measuring instruments provided that there can be no danger of confusion with conflicting markings carried out in accordance with a different system.

1.2 Unless otherwise agreed between the manufacturer and the user, these markings do not apply to:

a) energy meters,

b) maximum demand indicators,

c) electronic measuring instruments, and

d) instrument transformers.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Terminal — A conducting part of an instrument or an accessory which is provided to permit electrical connection of the instrument or accessory to an external circuit.

2.1.1 *Current Terminal* — A terminal which is provided to permit electrical connection of a current measuring circuit of an instrument or a current sensing circuit of an accessory to an external circuit.

2.1.2 *Potential Terminal* — A terminal which is provided to permit electrical connection of a voltage measuring circuit of an instrument or of the potential produced by an accessory to an external circuit.

2.2 Measuring Circuit — A circuit of an instrument which responds to a quantity to be measured or on which the measurement depends.

2.2.1 *Current Measuring Circuit* — A measuring circuit which responds to a current.

2.2.2 *Voltage Measuring Circuit* — A measuring circuit which responds to a difference of potential.

2.2.3 *Series Connected Measuring Circuit* — A measuring circuit which is connected so that the current which is to be measured, or on which the measurement depends (or a known proportion of it) passes through the circuit.

2.2.4 *Shunt Connected Measuring Circuit* — A measuring circuit which is connected so that the voltage which is to be measured, or on which the measurement depends (or a known proportion of it) is applied across the circuit.

2.3 External Circuit — A circuit external to an instrument and/or accessory.

2.4 Common Terminal — A terminal which is shared by two or more measuring circuits or to which a connection has to be made for all ranges of a multirange instrument or accessory.

2.5 Range-Selecting Terminal — One of several terminals of a multirange instrument or accessory to which the external circuit is connected, thereby determining the measuring range used.

2.6 Composite Instrument (Accessory) — An instrument (accessory) having both current measuring circuit(s) and voltage measuring circuit(s).

2.7 Non-polarised Instrument — An instrument which gives the same indication of a dc quantity to be measured before and after its connections are interchanged. In general, a non-polarised instrument will also operate on an ac quantity to be measured.

2.8 Portable Instrument — An instrument specially designed to be easily carried by hand.

The instrument is intended to be connected and disconnected easily by the user.

2.9 Auxiliary Circuit — Any circuit of a measuring instrument which is not a measuring circuit.

2.10 Source — The supply from which the energy-flow is positive in the circuit where the measurements are to be carried out.

2.11 Load — A sink of electrical energy.

3. MARKINGS, SYMBOLS AND THEIR MEANINGS

3.0 The following markings shall be used for terminals.

3.1 Capital Letters — Capital (upper case) letters of the Roman alphabet but not the letters A, E, I, N, O, U, V, W, except as specified in **3.1.3**, **3.1.4**, and **3.4.5** shall be used. The pairs of letters SL, MM, PE and TE are to be used only as specified in **3.4.1**, **3.4.2**, **3.4.3** and **3.4.4** respectively.

NOTE 1 — The letters I and O are not to be used to avoid confusion with the figures 1 and 0 (One and Zero).

NOTE 2 — The letters A, V and W are not to be used to avoid confusion with the symbols for the ampere, the volt and the watt (*see also* **3.1.3**).

NOTE 3 — The letter U is not to be used to avoid confusion with the symbol for voltage (*see also* **3.1.3**).

3.1.1 Letters from the beginning of the alphabet shall be used for the terminals of shunt-connected instruments such as voltmeters, and for the voltage-measuring circuits of composite instruments such as wattmeters.

3.1.2 Letters from the end of the alphabet shall be used for the terminals of series-connected instruments such as ammeters, and for the current-measuring circuits of composite instruments such as wattmeters.

3.1.3 Terminals which are intended to be connected to a three-phase ac source shall be marked U, V and W and shall, where important, be connected to the circuit so that the phases rise to their maximum values in the order U, V, W.

3.1.4 Terminals which are intended to be connected to the neutral of an ac source shall be marked N.

3.2 Hindu-Arabic Numerals

3.2.1 Hindu-Arabic numerals followed by the symbol for a unit of measurement shall be used to denote a measuring range.

3.2.2 Hindu-Arabic numerals shall be used as ordinal numbers.

3.2.3 The members of a pair of terminals of an ac circuit shall be distinguished by the Hindu-Arabic numerals 1 and 2. When the distinction is necessary, the sequence 1 - 2 shall correspond to the direction of the flow of energy. Thus, for a current-measuring circuit, terminal 1 will normally be connected to the source side and terminal 2 to the load side. Similarly, for a voltage-measuring circuit, terminal 1 will normally be connected to the conductor which, for a positive flow of energy, is considered as having the higher potential.

3.3 Symbols Relating to the Measured Quantity or to an Auxiliary Supply

3.3.1 Symbols of SI units together with their decimal multiple and sub-multiple prefixes (*see* IS : 3722-1966*) shall be used.

3.3.2 Symbol in **A-2.6** shall be used to denote a terminal which is intended to be connected to the positive pole of a dc source.

3.3.3 Symbol in **A-2.7** shall be used to denote a terminal which is intended to be connected to the negative pole of a dc source.

3.3.4 Symbol in **A-1.1** shall be used to denote a group (2 or more) of terminals which are intended to be connected to dc source.

3.3.5 Symbol in **A-1.2** shall be used to denote a group (2 or more) of terminals which are intended to be connected to an ac source.

*Letter symbols and signs used in electrical technology.

3.3.6 Symbol in **A-1.3** shall be used to denote a group (2 or more) of terminals which are intended to be connected either to a dc source or to an ac source.

3.3.7 Symbol in **A-1.4** shall be used to denote a group of terminals which are intended to be connected to a three-phase 3-wire ac source.

3.3.8 Symbol in **A-1.5** shall be used to denote a group of terminals which are intended to be connected to a three-phase 4-wire ac source.

3.4 Symbols Relating to Earthing and Protection

3.4.1 Symbol in **A-2.5** shall be used for a measuring circuit terminal which shall be maintained near to earth (ground) potential. The letters SL may also be used for this purpose.

3.4.2 Symbol in **A-2.2** shall be used for a terminal which is connected to the frame or chassis of an instrument or apparatus. The letters MM may also be used for this purpose.

3.4.3 Symbol in **A-2.3** shall be used for a terminal which is intended to be connected to a protective earth (ground). The letters PE may also be used for this purpose.

3.4.4 Symbol in **A-2.4** shall be used for a terminal which is intended to be connected to a noiseless earth (ground). The letters TE may also be used for this purpose.

3.4.5 Symbol in **A-2.1** may be used to mark an earth (ground) terminal which is otherwise not specifically distinguished. The letter E may also be used for this purpose.

4. REQUIREMENTS FOR MARKINGS

4.1 The markings shall be applied on or adjacent to the relevant terminal.

4.2 If there is insufficient space adjacent to the terminals for the markings specified, a permanently attached name-plate shall be provided having details of the terminals and identifying them by means of a topographical diagram or by means of Hindu-Arabic numerals. The manufacturer may select any convenient and non-conflicting numerals. These numerals shall also be marked on or adjacent to the relevant terminals.

4.3 The markings shall be non-fading and indelible and of a colour which contrasts with the background.

4.4 A marking shall not be applied to a removable part of a terminal (such as a terminal head)

4.4.1 If markings are applied to a cover over several terminals, it shall not be possible to fit the cover so that the markings are incorrect.

4.5 When a diagram of connections is supplied, the marking for a terminal shall be identical to that on the diagram of connections relating to that terminal.

4.6 Other markings should not be used, but if essential, in no case shall:

a) a different meaning be attached to markings specified in this standard, and

b) conflicting principles of marking be employed.

5. APPLICATION TO TERMINALS OF SERIES-CONNECTED CIRCUITS

5.1 DC Current Circuits

5.1.1 If there is only one measuring circuit, the terminals shall be marked Y+ and Y−:

Y+ being used for the terminal intended to be connected (directly or indirectly) to the positive pole of the source, and

Y− being used for the terminal intended to be connected (directly or indirectly) to the negative pole of the source.

If there is only one range and if there is no possibility of confusion, the positive terminal only need be marked using symbol in **A-2.6** (+) (*see* Fig. 1, P 18).

5.1.2 If there is more than one current measuring circuit, the terminals of each circuit shall be marked Y+ and Y−, Z+ and Z−.

If there are more than two circuits, letters from the end of the alphabet shall additionally be used in reverse sequence, but not the letters U, V and W (*see* **3.1.3**) (*see* Fig. 2, P 18).

5.1.3 If there are more than two terminals for a current measuring circuit the range-selecting terminals shall be marked to show the measuring range to which they refer by following the initial capital letter by the rated value of the range in Hindu-Arabic numerals, the multiplier prefix (if any) and the symbol of the unit, followed by a polarity symbol, for example, Y100mA+, Y10mA+ and Y− if the negative terminal is common to the ranges (*see* Fig. 3, P 18).

If the positive terminal is common to the ranges, the marking for, for example, a 2 range 0—50mA, 0—100mA ammeter would be Y+, Y50mA− and Y100mA− (*see* Fig. 4, P 19).

5.2 AC Current Circuits

5.2.1 If there is only one measuring circuit, the terminals shall be marked Y1 and Y2.

Where it is important, Y1 shall be used for the terminal which is intended to be connected to the source and Y2 for the terminal which is intended to be connected to the load.

If there is only one range and if there is no possibility of confusion the initial capital letter Y may be omitted. If, in addition, either terminal may be connected to the source or to the load, neither terminal need have any marking (*see* Fig. 5, P 19).

5.2.2 If there is more than one current measuring circuit, the terminals shall be marked Y1 and Y2, Z1 and Z2, etc.

5.2.3 If there are three current measuring circuits intended to be connected to a three-phase ac circuit, the terminals shall be marked U1 and U2, V1 and V2, W1 and W2 (*see* **3.1.3**) being connected respectively to phases L1, L2 and L3, so that the phases rise to their maximum values in the same order (*see* Fig. 6, P 19).

5.2.4 If there are more than two terminals for a current measuring circuit, the range-selecting terminals shall be marked to show the measuring range to which they refer by following the initial capital letter by the rated value of the range in Hindu-Arabic numerals, the multiplier prefix (if any) and the symbol of the unit, followed by one of the numerals 1 or 2. The terminal which is common to the measuring ranges shall be marked Y1 if it is intended to be connected to the source or Y2 if it is intended to be connected to the load. The final numeral for the range-selecting terminals shall be 2 in the former case and 1 in the latter case.

If there is no preferred mode of connection, the numerals 1 and 2 shall be omitted (*see* Fig. 7 and 8, P 19 and 20).

5.2.5 A polyphase multi-range ammeter shall combine the requirements of **5.2.4** and **5.2.2** or **5.2.3** (*see* Fig. 9, P 20).

NOTE — It is possible to distinguish between the numerals 1 and 2 referring to the rating of a current-measuring range and referring to the marked terminal being intended to be connected to the source or the load, as the use for a rating will always be followed by the symbol of the unit of measurement preceded, if necessary, by its multiplier prefix.

5.2.6 When a terminal of a current measuring circuit is intended to be connected to the neutral terminal of a source, it shall be marked with a capital N (*see* Fig. 10, P 20).

5.2.7 When an ac ammeter is intended to be connected in the return (neutral) conductor of a load, the terminal connected to the load shall be marked with the numeral 1, not the numeral 2 as required by **5.2.1** and **5.2.3**, as the concept is that of energy-flow from terminal 1 to terminal 2, rather than that of direct connection to source or load.

6. APPLICATION TO TERMINALS OF SHUNT-CONNECTED CIRCUITS

6.1 DC Voltage Circuits

6.1.1 If there is only one measuring circuit, the terminals shall be marked B+ and B−:

B+ being used for the terminal intended to be connected (directly or indirectly) to the positive pole of the source, and

B− being used for the terminal intended to be connected (directly or indirectly) to the negative pole of the source.

If there is only one range and if there is no possibility of confusion, the positive terminal only need be marked using symbol in **A-2.6** (+) (*see* Fig. 11, P 20).

6.1.2 If there is more than one voltage measuring circuit, the terminals of each circuit shall be marked B+ and B−, C+ and C−, and D+ and D−, etc, the earlier letters of the alphabet being employed first (*see* Fig. 12, P 21).

6.1.3 If two or more voltage measuring circuits share a common terminal, the terminal shall carry the markings relevant to each of the circuits, one above the other (*see* Fig. 13, P 21).

6.1.4 If there are more than two terminals for a voltage measuring circuit, the range-selecting terminals shall be marked to show the measuring range to which they refer by following the initial capital letter by the rated value of the range in Hindu-Arabic numerals, the multiplier prefix (if any) and the symbol of the unit followed by a polarity symbol, for example, B200V+, B100V+ and B− if the negative terminal is common to both ranges (*see* Fig. 14 P 21).

If the positive terminal is common to both ranges, the marking in this example would become B+, B200V− and B100V−.

6.2 AC Voltage Circuits

6.2.1 If there is only one measuring circuit, the terminals shall be marked B1 and B2.

Where it is important, B1 shall be used for the terminal which is intended to be connected to the conductor having the higher potential for a positive flow of energy and B2 shall be used for the terminal which is intended to be connected to the conductor having the lower potential.

If there is only one range and if there is no possibility of confusion, the initial capital letter B may be omitted. If in addition, either terminal

may be connected to either conductor, neither terminal needs to have any marking (*see* Fig. 15, P 22).

6.2.2 If one of the terminals must be connected to the neutral of the source, it shall be marked N, the other terminal being marked B1 (*see* Fig. 16, P 22).

6.2.3 If a single element voltage circuit is intended to be connected between phases of a polyphase ac source, the terminals shall be marked B1 and B2 as in **6.2.1.**

NOTE — If this measuring element is used alone, the numerals and letters may be omitted.

6.2.4 If there is more than one voltage measuring circuit, the terminals of each circuit shall be marked B1 and B2, C1 and C2, D1 and D2, etc, the earlier letters of the alphabet being employed first. If the voltage measuring circuits are to be connected to a polyphase circuit, terminal B1 shall be connected to phase L1, terminal C1 to phase L2, etc (*see* Fig. 17, P 22).

6.2.5 If one terminal of each voltage measuring circuit of a multi-element instrument must be connected to the neutral pole of a polyphase ac source, they shall be marked BN, CN, DN, etc, respectively (*see* Fig. 18, P 23).

6.2.6 If all the voltage measuring circuits are connected to a single common terminal, it shall be marked N (*see* Fig. 19, P 23).

6.2.7 If a three phase voltage measuring circuit has only three terminals, intended to be connected to the three phase conductors, the terminals shall be marked B1, C1 and D1. If it is important, the terminals B1, C1 and D1 shall be connected respectively to phases L1, L2 and L3 so that the phases rise to their maximum values in the same order (*see* Fig. 20, P 23).

6.2.8 If there are more than two terminals for a voltage measuring circuit the range-selecting terminals shall be marked to show the measuring range to which they refer by following the initial capital letter by the rated value of the range in Hindu-Arabic numerals, the multiplier prefix (if any) and the symbol of the unit, followed by numeral 1.

The common terminal shall be marked with the same initial capital letter as the range-selecting terminals, followed by the Hindu-Arabic numeral 2, when the common terminal is intended to be at the same potential or at a lower potential than the range-selecting terminals for a positive flow of energy (*see* Fig. 21, P 24).

If there is no preferred mode of connection, the numerals 1 and 2 shall be omitted.

6.2.9 If the common terminals must be connected to the source neutral, it shall be marked with a capital N.

6.2.10 If the common terminal is intended to be at a higher potential than the range-selecting terminals for a positive flow of energy, its final numeral shall be 1 and the final numeral of the range-selecting terminals shall be 2.

7. COMPOSITE INSTRUMENTS

7.1 Instruments incorporating both current measuring and voltage measuring elements shall follow the rules stated in **5** and **6** for each element separately.

7.2 When a current measuring circuit and a voltage measuring circuit have a common terminal, that terminal shall carry the markings relating to both the circuits, one above the other (*see* Fig. 22 and 23, P 24).

7.3 Three-phase instruments shall have their voltage measuring circuit terminals identified as B, C, D and their current measuring circuit terminals as U, V, W. Circuit B shall be connected to the same phase as circuit U: circuit C shall be connected to the same phase as circuit V, and circuit D shall be connected to the same phase as circuit W (*see* Fig. 24 and 25, P 25).

8. NON-POLARISED INSTRUMENTS

8.1 Instruments which are intended to be used on either dc circuits or on ac circuits shall have their terminals marked as if they were ac instruments.

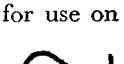
9. PORTABLE INSTRUMENTS

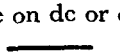
9.1 When it is possible for the user to see the face of the instrument while he is connecting it into circuit and therefore to know the nature and range(s) of the measured quantity, the terminal markings may be simplified or sometimes omitted completely when there is no danger of confusion.

10. ACCESSORIES

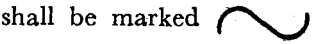
10.1 Interchangeable Accessories

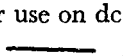
10.1.1 *Interchangeable Shunts* — If the shunt is intended for use on dc only, one current terminal shall be marked + (symbol in **A-2.5**); the other current terminal shall be marked with the rated current of the shunt. The potential terminal associated with the current terminal marked + shall also be marked +; the other potential terminal shall be marked with the rated potential drop of the shunt (*see* Fig. 26, P 25).

If the shunt is intended for use on ac only, the terminals specified to be marked + shall be marked  (symbol in **A-1.2**).

If the shunt is intended for use on dc or on ac, the terminals specified to be marked + shall be marked  (symbol in **A-1.3**).

10.1.2 *Interchangeable Series Impedances* — If the series impedance is intended for use on dc only, one terminal shall be marked + (symbol in **A-2.5**), the other terminal(s) shall be marked with the rated potential difference between it (them) and the terminal marked +.

If the series impedance is intended for use on ac only, the terminal specified to be marked + (symbol in **A-2.5**) shall be marked  (symbol in **A-1.2**).

If the series impedance is intended for use on dc or on ac the terminal specified to be marked + shall be marked  (symbol in **A-1.3**).

In addition, the interchangeable series impedance shall either be marked with its resistance (or impedance at a marked frequency) expressed in ohms or with its rated current (*see* Fig. 27, P 26).

10.2 Accessories of Limited Interchangeability and Non-interchangeable Accessories

10.2.1 *Shunts of Limited Interchangeability and Non-interchangeable Shunts* —The current terminals shall be marked in accordance with **5**. The potential terminals shall be marked with the Hindu-Arabic numerals. The manufacturer may select any convenient and non-conflicting numerals. The associated instrument shall have its terminals marked with the same numerals as the terminals of the accessory to which they are intended to be connected (*see* Fig. 28, P 26).

10.2.2 *Series Impedances of Limited Interchangeability and Non-interchangeable Series Impedances* — The terminal(s) intended for connection to the external circuit shall be marked in accordance with **6**. The terminals intended to be connected to the associated instrument shall be marked with the Hindu-Arabic numerals. The manufacturer may select any convenient and non-conflicting numerals. The associated instrument shall have its terminals marked with the same numbers as the terminals of the accessory to which they are intended to be connected.

10.2.3 *Composite Accessories of Limited Interchangeability and Non-interchangeable Composite Accessories* — The terminals of series connected circuits which are intended to be connected to external circuits shall be marked in accordance with **5**. The terminals of shunt connected circuits which are intended to be connected to external circuits shall be marked in accordance with **6**. The

terminals intended to be connected to the associated instrument shall be marked with the Hindu-Arabic numerals. The manufacturer may select any convenient and non-conflicting numerals. The associated instrument shall have its terminals marked with the same numerals as the terminals of the accessory to which they are intended to be connected (*see* Fig. 29, P 26).

11. AUXILIARY CIRCUITS

11.1 The terminals of all auxiliary supply circuits shall be marked to show the nature (dc, ac, etc) and characteristics (voltage, frequency, etc) of the auxiliary supply to which they are intended to be connected. If the terminals are arranged as a group, a single marking adjacent to the group will suffice. The marking shall include such of the following information as is relevant:

a) Rated voltage or rated range of voltage;

b) Rated frequency or rated range of frequency;

c) An indication of the power requirements, given in amperes, volt-amperes or watts; and

d) The nature of the supply using :

 (symbol in **A-1.1**) for a dc supply,

 (symbol in **A-1.2**) for an ac supply,

 (symbol in **A-1.3**) for a supply which may be dc or ac.

11.2 Other auxiliary circuits such as alarm contacts and timing circuits, shall have their terminals marked by capital letters from near the middle of the alphabet and/or Hindu-Arabic numerals. The details of these are at the choice of the manufacturer but they shall not conflict with any of the requirements of this standard or duplicate other markings on the instrument and/or accessory.

12. TRANSMISSION OF INFORMATION CONCERNING TERMINAL MARKINGS

12.0 When an information transmission system (such as a teletype) has only an alpha-numeric and/or single case capability, the following shall apply when using it to transmit terminal markings.

12.1 If the character set available includes both capital (upper case) and small (lower case) letters, the symbols for units of measurement and their prefixes shall be normal ones specified in SP : 5-1969* where these use letters of the Roman alphabet.

*Guide to the use of international system (SI) units.

12.2 Unit symbols and prefixes needing characters other than those of the Roman alphabet shall be transmitted using the representations given in Appendix B.

12.3 If only a capital (upper case) or a small (lower case) alpha-character set is available, unit symbols and prefixes shall be transmitted using the representation given in Appendix B. Capital (upper case) or small (lower case) letters may be used, as available.

12.4 Symbols given in Appendix A may be transmitted using either the reference number of Appendix A or the descriptive letter(s), if any.

12.5 If a capital (upper case) character set is not available, the capital letters specified in **3** may be transmitted using small (lower case) characters.

12.6 When a terminal needs two markings (common terminal) (*see* **7.2**), the two markings shall be transmitted in sequence separated by an oblique line, for example, Y1/B2.

12.7 The representations specified in **12** shall be used only for the transmission of the information concerning terminal markings. The representations shall be converted back into the form specified by the remainder of this standard before publication of the information.

APPENDIX A

[*Clauses* 3.3.2 to 3.3.8, 3.4.1 to 3.4.5, 5.1.1, 6.1.1, 10.1.1, 10.1.2, 11.1(d) *and* 12.4]

SYMBOLS FOR MARKING THE TERMINALS OF INSTRUMENTS AND ACCESSORIES

A-1. TYPE OF SUPPLY AND NUMBER OF MEASURING CIRCUITS

No.	Item	Symbol	Descriptive Letter (s)
A-1.1	Direct current circuit	⎓	DC
A-1.2	Alternating current	~	AC
A-1.3	Direct and/or alternating current circuit	≂	DC/AC
A-1.4	Three-phase 3-wire alternating current circuit	3~	

Name	*Symbol*	*Representation*
giga 10^9	G	G
mega 10^6	M	MA
kilo 10^3	k	K
milli 10^{-3}	m	M
micro 10^{-6}	μ	U
nano 10^{-9}	n	N
pico 10^{-12}	p	P
femto 10^{-15}	f	F
atto 10^{-18}	a	A

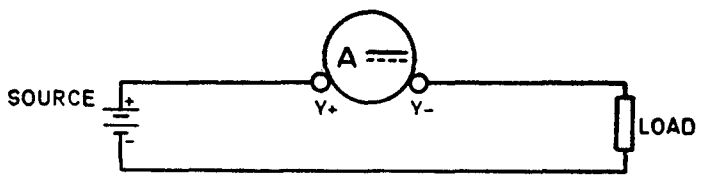


FIG. 1 SINGLE RANGE DC AMMETER

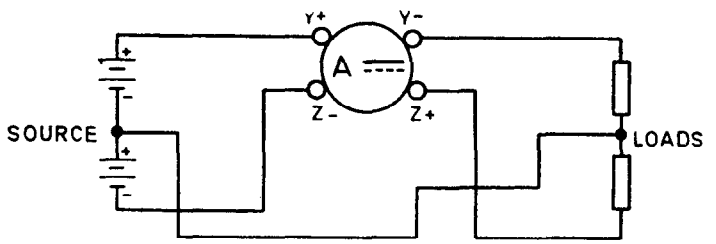


FIG. 2 TWO ELEMENT, SINGLE RANGE DC AMMETER

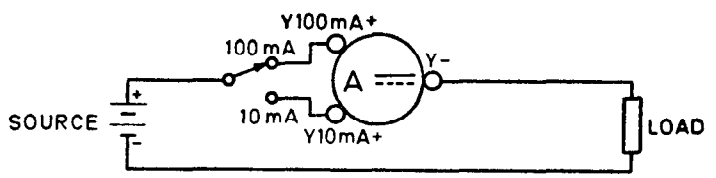


FIG. 3 TWO RANGE, SINGLE ELEMENT DC AMMETER: NEGATIVE TERMINAL COMMON TO BOTH RANGES

APPENDIX B

(*Clauses* 12.2 *and* 12.3)

REPRESENTATION OF UNITS OF MEASUREMENT AND PREFIXES IN TRANSMISSION SYSTEMS HAVING A LIMITED CHARACTER SET

Name	*Symbol*	*Representation*
metre	m	M
kilogram	kg	KG
second	s	S
ampere	A	A
kelvin	K	K
mole	mol	MOL
candela	cd	CD
radian	rad	RAD
steradian	sr	SR
hertz	Hz	HZ
newton	N	N
pascal	Pa	PA
joule	J	J
watt	W	W
coulomb	C	C
volt	V	C
farad	F	F
ohm	Ω	OHM
siemens	S	SIE
weber	Wb	WB
tesla	T	T
henry	H	H
lumen	lm	LM
lux	lx	LX
degree (angle)	°	DEG
degree Celsius	°C	CEL
tera 10^{12}	T	T

Name	*Symbol*	*Representation*
giga 10^9	G	G
mega 10^6	M	MA
kilo 10^3	k	K
milli 10^{-3}	m	M
micro 10^{-6}	μ	U
nano 10^{-9}	n	N
pico 10^{-12}	p	P
femto 10^{-15}	f	F
atto 10^{-18}	a	A

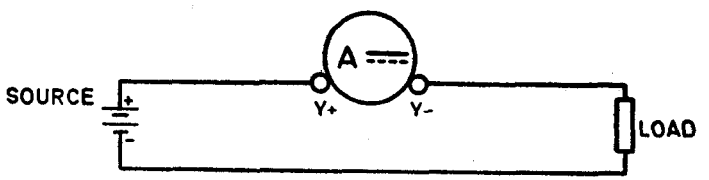


FIG. 1 SINGLE RANGE DC AMMETER

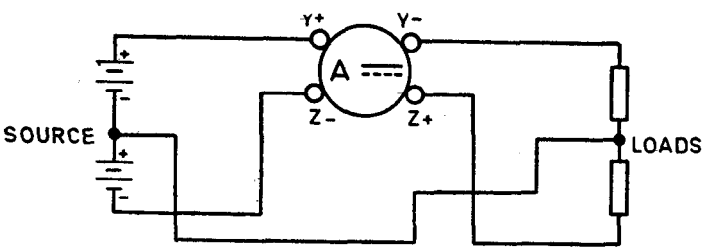


FIG. 2 TWO ELEMENT, SINGLE RANGE DC AMMETER

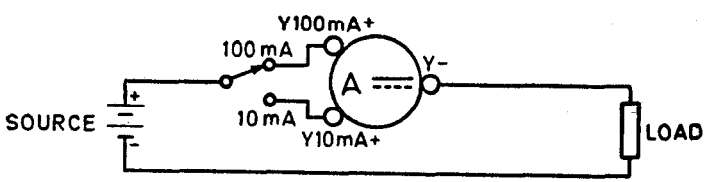


FIG. 3 TWO RANGE, SINGLE ELEMENT DC AMMETER: NEGATIVE TERMINAL COMMON TO BOTH RANGES

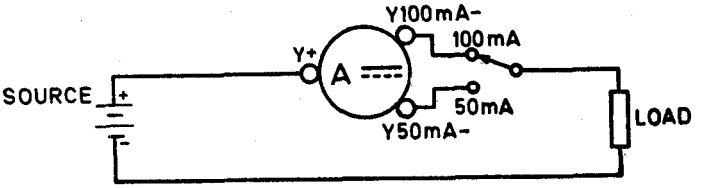


FIG. 4 TWO RANGE, SINGLE ELEMENT DC AMMETER: POSITIVE TERMINAL COMMON TO BOTH RANGES

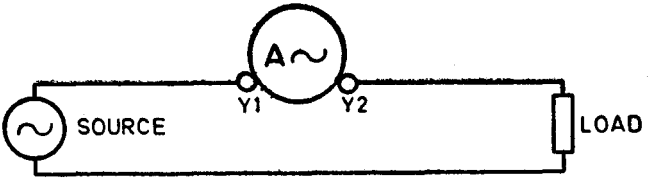


FIG. 5 SINGLE RANGE AC AMMETER

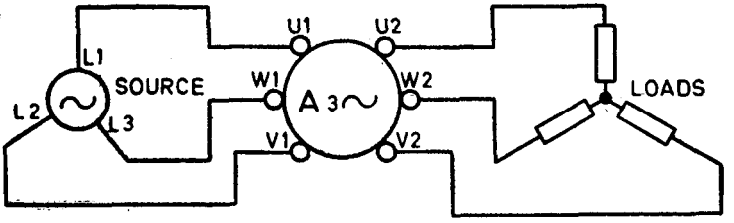


FIG. 6 THREE PHASE, SINGLE RANGE AC AMMETER

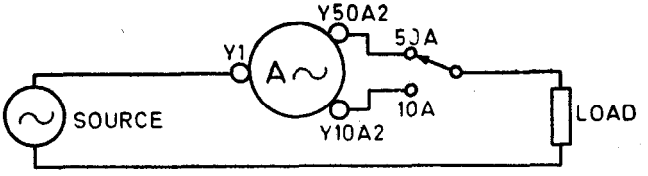


FIG. 7 TWO RANGE AC AMMETER: COMMON TERMINAL CONNECTED TO SOURCE

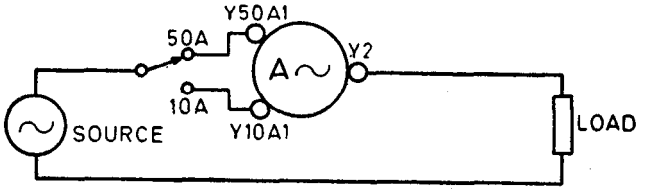


FIG. 8 TWO RANGE AC AMMETER: COMMON TERMINAL CONNECTED TO LOAD

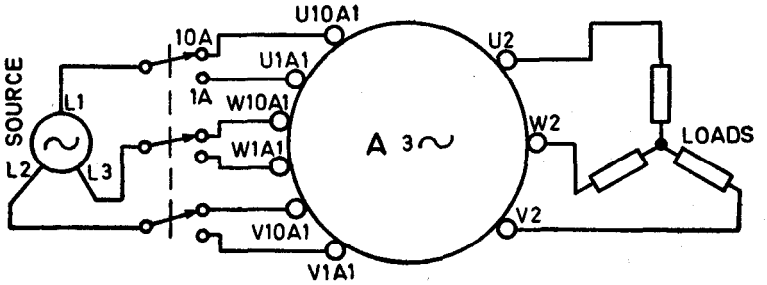


FIG. 9 TWO RANGE THREE PHASE AC AMMETER: COMMON TERMINALS CONNECTED TO LOADS

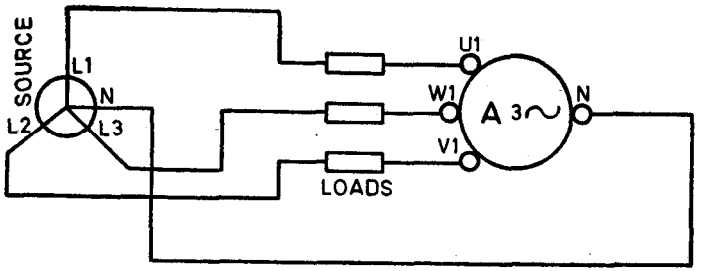


FIG. 10 THREE PHASE SINGLE RANGE LOAD-BALANCE AMMETER

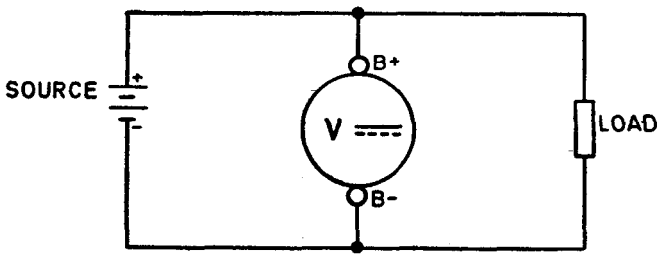


FIG. 11 SINGLE RANGE SINGLE ELEMENT DC VOLTMETER

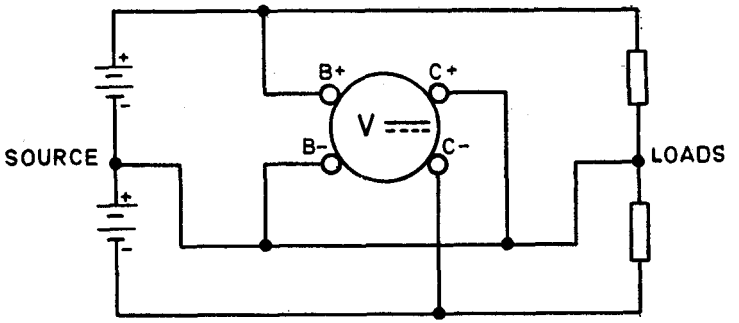


FIG. 12 SINGLE RANGE TWO ELEMENT SUPPLY-BALANCE VOLTMETER

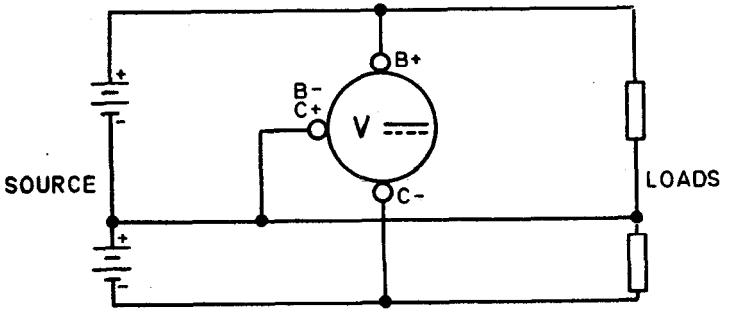


FIG. 13 SINGLE RANGE TWO ELEMENT DC SUPPLY-BALANCE VOLTMETER : ONE TERMINAL COMMON TO BOTH ELEMENTS

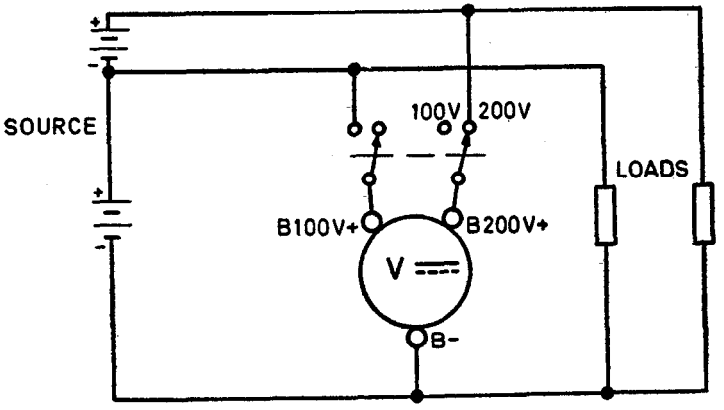


FIG. 14 TWO RANGE SINGLE ELEMENT DC VOLTMETER : NEGATIVE TERMINAL COMMON TO BOTH RANGES

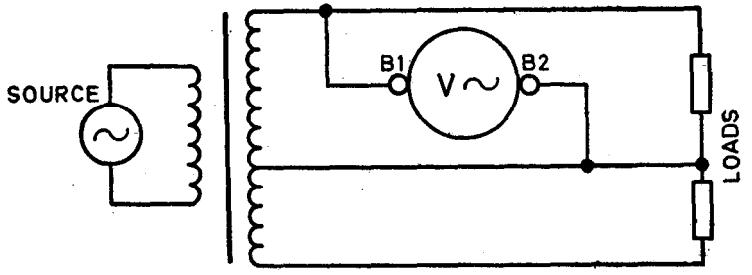


FIG. 15 SINGLE ELEMENT SINGLE RANGE AC VOLTMETER

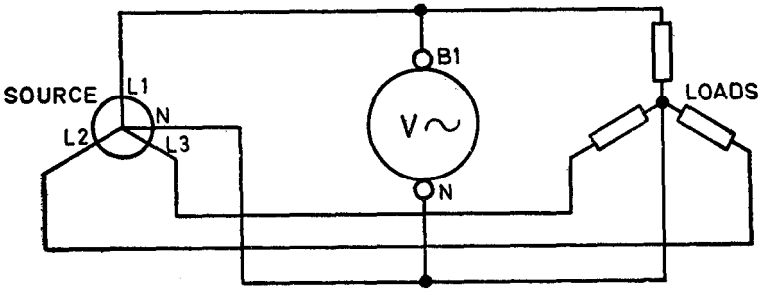


FIG. 16 SINGLE RANGE SINGLE ELEMENT AC VOLTMETER: TERMINAL MARKED N SHALL BE CONNECTED TO THE NEUTRAL

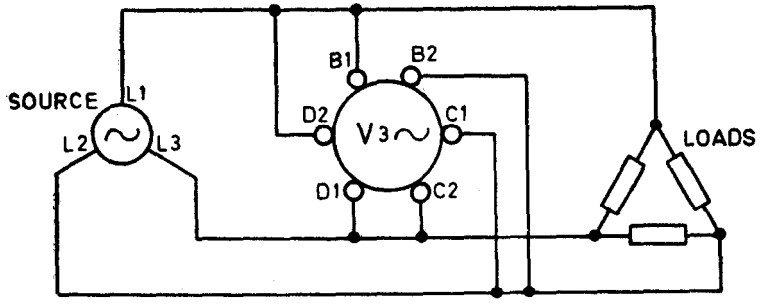


FIG. 17 SINGLE RANGE THREE ELEMENT AC VOLTMETER

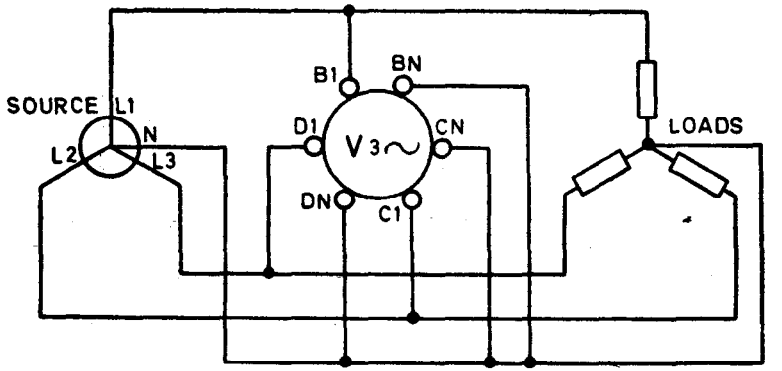


FIG. 18 SINGLE RANGE THREE ELEMENT AC VOLTMETER : TERMINALS MARKED BN, CN AND DN SHALL BE CONNECTED TO THE NEUTRAL

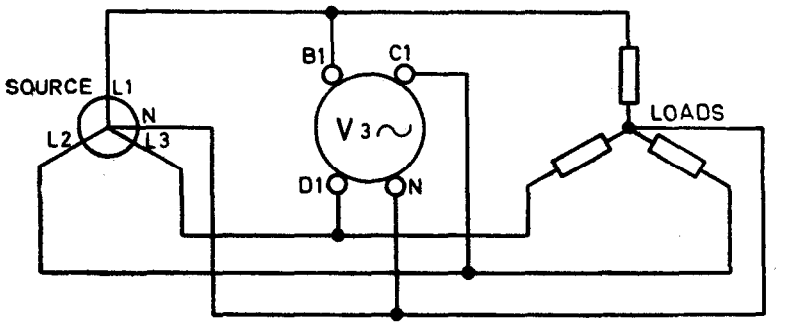


FIG. 19 SINGLE RANGE THREE ELEMENT AC VOLTMETER WITH MEASURING ELEMENTS CONNECTED IN STAR : STAR POINT SHALL BE CONNECTED TO THE NEUTRAL

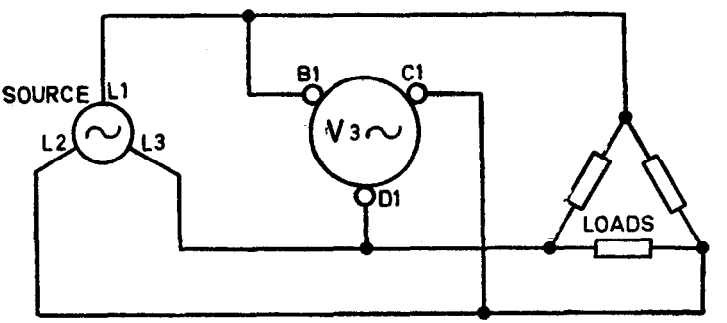


FIG. 20 SINGLE RANGE THREE ELEMENT AC VOLTMETER WITHOUT STAR POINT TERMINAL

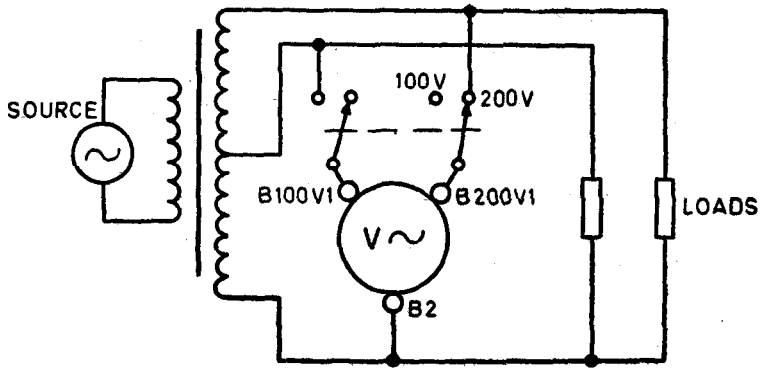


FIG. 21 SINGLE ELEMENT TWO RANGE AC VOLTMETER

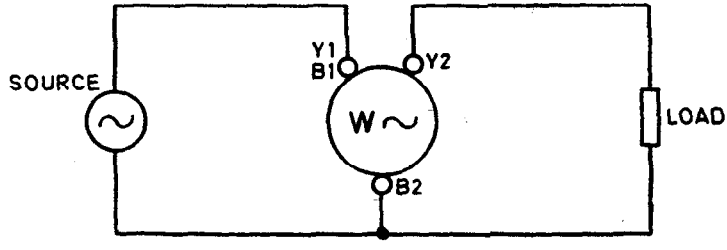


FIG. 22 SINGLE PHASE SINGLE RANGE AC WATTMETER WITH ONE TERMINAL COMMON TO BOTH MEASURING ELEMENTS : VOLTAGE CIRCUIT CONNECTED ON SOURCE SIDE OF CURRENT MEASURING ELEMENT

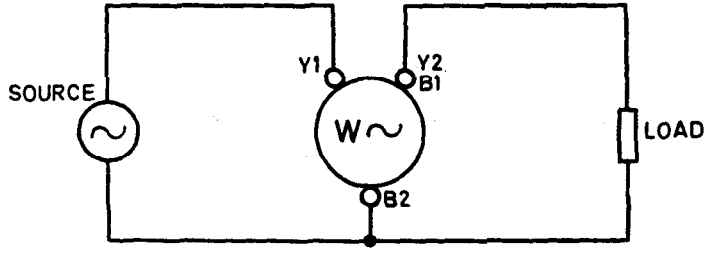


FIG. 23 SINGLE PHASE SINGLE RANGE AC WATTMETER WITH ONE TERMINAL COMMON TO BOTH MEASURING ELEMENTS : VOLTAGE CIRCUIT CONNECTED ON LOAD SIDE OF CURRENT MEASURING ELEMENT

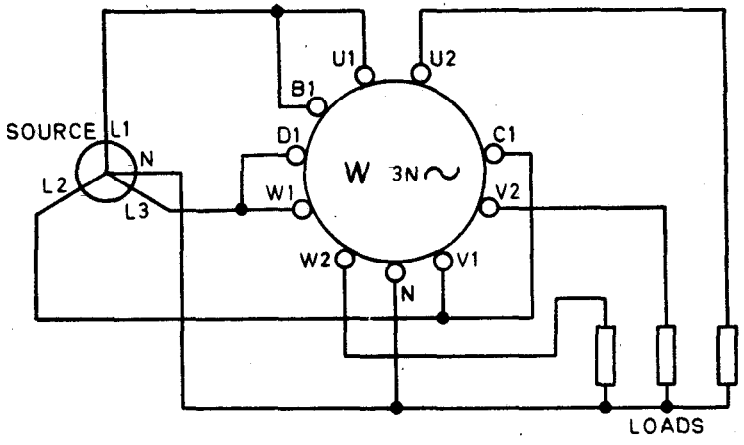


FIG. 24 THREE PHASE FOUR WIRE WATTMETER WITH ALL VOLTAGE CIRCUITS ISOLATED FROM CURRENT CIRCUITS : VOLTAGE CIRCUITS CONNECTED ON SOURCE SIDE OF CURRENT MEASURING ELEMENTS : VOLTAGE STAR POINT SHALL BE CONNECTED TO THE NEUTRAL

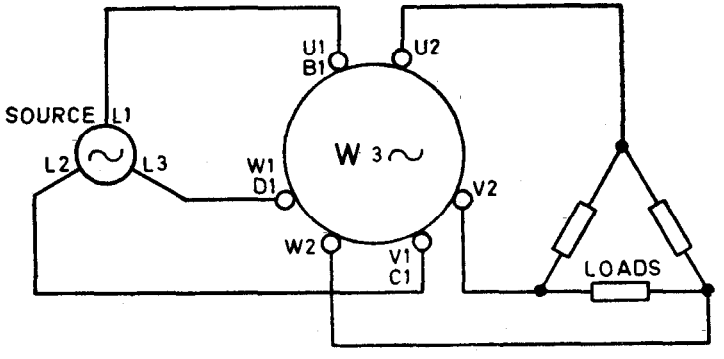


FIG. 25 THREE PHASE THREE WIRE WATTMETER : DELTA CONENCTED VOLTAGE CIRCUITS COMMON TO CURRENT TERMINALS ON SOURCE SIDE

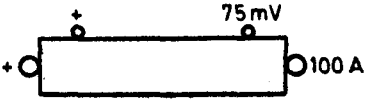
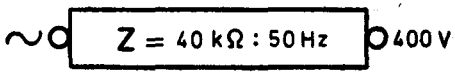


FIG. 26 DC SHUNT



NOTE — This accessory would be suitable for converting a 100 V 50 Hz voltmeter drawing 10 mA at an indication of 100 V into a 500 V voltmeter.

FIG. 27 INTERCHANGEABLE 400 V 10 mA SERIES IMPEDANCE

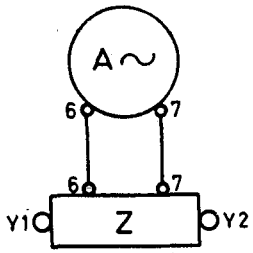


FIG. 28 AC AMMETER WITH NON-INTERCHANGEABLE SHUNT

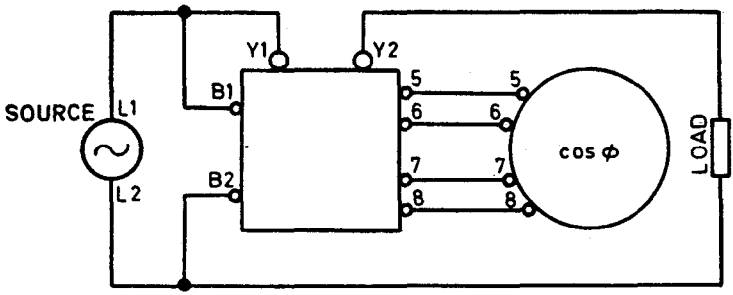


FIG. 29 SINGLE PHASE POWER FACTOR METER WITH ACCESSORY BOX OF LIMITED INTERCHANGEABILITY

BUREAU OF INDIAN STANDARDS

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331 13 75

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